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032) to the square mile? Is this a dense population? Account for this.

10. Construct a square, the sides of which are each 5 units (inches) long, and rule it into small squares, the number of which equals the average population on twenty-five square miles in Spain, in Italy, in the United States, in the world. A population above the average in density would be called a dense population, below the average would be a sparse population. What country has the average population? What countries are densely populated? What ones are sparsely populated?

11. The length of the Ebro is equal to fifteen times the distance of its source from the ocean. Why is this?

12. Compare the Ebro with the Po in length.

13. Compare the basin of the Ebro (3,800 square miles) with the basin of the Po (29,000 square miles).

14. The average discharge of the Ebro is 3,500 cubic feet per second, while the Po discharges on an average 60,734 cubic feet per second. How do you account for this?

15. Compare the average temperature of Spain with the average temperature of Chicago for the last twenty-five years (consult U. S. Weather Bulletin).

16. Compute the yearly rainfall at Chicago. Compare this with Spain.

The work in Manual Training will require the use of geometry.

Algebra will be taken up this month. It will be taught in the closest connection with mensuration, and in accordance with the plan suggested by Mr. G. W. Myers in the December COURSE OF STUDY. Additional problems will also be found in the Eighth Grade outline in this issue.

Oral Reading: The study of Julius Cæsar will be continued.

Manual Training: In correlation with the month's work in Nature Study, the pupils will construct the model of a house. This will involve a study of the materials to be used. Tests will be applied to determine the fitness of the various woods for the necessary parts of the house. The pupils will discuss different methods of construction.

Music: The work for the Seventh and Eighth Grades will be much the same as for the Fifth and Sixth, there being slight difference in the groups in respect to ability to sing the rote-songs, and in the technical exercises required. Work in sight-reading will be done by these grades, and a large number of the simple songs in the first part of the "Primer," Modern Music Series, will be used for this purpose.

Songs: *Ring Out, Wild Bells*, Modern Music Series, Second Book; *Winter Song, Three Part Round* (p. 104), *Three Part Round* (p. 111), Modern Music Series, First Book; *Welcome, Wild Northeaster, In the Tempest, Winter and Spring, A Snowy Day*, Modern Music Series, Third Book; *On the Wild Rose-Tree*, Songs of Life and Nature.

Cooking: The next quarter will be spent, at the suggestion of the children, in learning to prepare and serve an Easter dinner, for their teachers. The pleasure that it will give the teachers will be used to arouse a desire in the children for a knowledge of the foods and food materials used. The children will be asked to bring in menus for the dinner, and these will be discussed in the class, with special reference to food values and cost.

Industrial Art: Textiles. The Seventh Grade will weave small rugs or mats on the school loom. They will begin the making of textile design on the squared paper, and the building of the chain.

Eighth Grade

Nott William Flint

Nature Study: I. VENTILATION AND HEATING (continued): The class will now see that a house, like the people who dwell in it, must be made to breathe, else it will prove unfriendly to human life. Also, that ventilation in most of our houses is a matter of chance, due to an ill-fitting door or window—the mistake of a carpenter.

The actual problem for ventilation which any given building presents may now be taken up, together with a study of the methods of heating.

II. An examination of the ventilating conditions in any given place will embody the following inquiries: (a) Cubic space in given room or building. (b) Size and position of outlets and inlets. (c) Distribution of air over room from inlets. (d) Amount of fresh air supplied per person per hour. (e) Examination of motive forces used to induce air movements.

NOTE.—(a) In getting cubic space of rooms the student should make corrections for all inequalities of walls, all projections into room, and all solid articles. For instance, 10 cubic feet should be allowed for a bedstead and bedding; for an adult person 3 cubic feet. (b) Size of inlets and outlets: Ventilating area of perforated bricks, or of gratings, can be found by measuring actual superficial area, and calculating relative size of interstices. In inlets, accumulations of dust should be noted; in outlets, any impediment to a free passage. In open fire-places find area of smoke flue (flue should have 16 square inches for every square foot of grate). If doors and windows are the only means of ventilating a room, what is their best adjustment? For the examination of a system of artificial ventilation, the architect's plans should be seen, if possible. (c) Direction of air currents in room may be determined easily by one of the following methods: Smoke from bit of smoldering cotton; floating fibers of floss silk, or bits of feather; candle flame (good only where current is strong). (N.B., get children to think up ways of determining currents.) Direction of air at different times and under different weather conditions. Doors and windows, if not part of the system of ventilation, should be closed during examination.

ANEMOMETER: If this instrument can be had, the exact volume and velocity of direct air currents may be determined. Note: Set anemometer well inside opening to be measured, and take time unit with watch; then multiply the resulting linear velocity by sectional area of opening.

III. The children should now work out the principles underlying the two systems of ventilation, and discuss the advantages of each.

1. Plenum: (a) Air is forced into room and building. (b) Does not suck foul air from sewers and basements. (c) Not disturbed by wind.

2. Exhaust: (a) By means of mechanical fans. (b) By heated flue or flues.

IV. Heating of houses: Each student will make a full report on the heating apparatus in his own house. (a) The open fire. (b) The close stove. (c) Hot water and steam.

Field Trip: The class will visit the Newberry Library with the special object of seeing a system of ventilation at work.

Manual Training: Some members of the class will make a model house with a glass side for the purpose of studying the principles of ventilation. N. B., A chalk box with a glass slide will do for this experiment. Cut a hole in one end and at the top. Through the hole at the top fit a common argand chimney; beneath this place a bit of candle. If a piece of smoking rag be held at the end opening, through the glass side of the box, ventilation can be seen going on.

History and Geography: (See Miss Stilwell's Seventh Grade outline.)

Mathematics: The work in Nature Study for this month is full of suggestions for number work. The computation of areas and of cubic spaces of rooms and buildings, together with the many corrections to be made for irregularities of wall and for projections into room, will give much practice in number work. In January, also, the grade will begin the study of algebra, using Professor Myer's algebra for Seventh and Eighth Grades, published in the December COURSE OF STUDY, as well as the following problems, also his:

Algebra for the Seventh and Eighth Grades: (GEORGE W. MYERS.) Algebra should not be taught as a separate subject in the grammar grades. In the writer's opinion it may, however, be studied with the greatest profit from the fifth grade upward, *if it is kept in closest connection with the work in arithmetical number*. The grade work in algebra should aim to teach:

1. The meaning of the representation of

magnitude by letters, including much of the notation and symbolism.

2. The use of the method of *mathematical induction.*

3. The significance and advantage of the equation as a concise expression of the general truths of number.

4. The first steps in the translation of symbolic statements into verbal statements and *vice versa.*

The first of these aims is best reached through the representation by letters of the lines, areas, and volumes which occur in mensuration. The second and third are secured by generalizing from a number of well-understood, concrete arithmetical problems to their algebraic analogue. The fourth is well attained by requiring the symbolized statement of the general truth before the rule is taught, the rule always being reached simply by expanding the formula into words. The following exercises are a continuation of what was begun in the December COURSE OF STUDY under the caption *Pedagogic School.* As a rule, each algebraic problem is preceded by a *single* simple arithmetical exercise, which is to be regarded as typical of such as will be readily supplied at the teacher's discretion as a basis for the algebraic generalization. Teachers are requested to try these exercises in the Fifth and Sixth grades and report results to G. W. Myers of the Chicago Institute.

45. Cut from paper a right triangle having two of its sides 1 inch long. Call one of the small angles x. Fold the paper about a line through the vertex of the right angle and the middle point of the long side. What other angle of the triangle may be called x? Referring to Example 40, can you write an equation from which you can find the value of x in degrees?

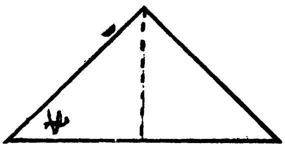

FIG. 37

46. If the short side of the triangle of Example 45 be called x and the long side y, write an equation for the perimeter and another for the area and find the values of x and y from these equations.

NOTE.—For the surface unit use the square of the linear unit in terms of which you express the sides.

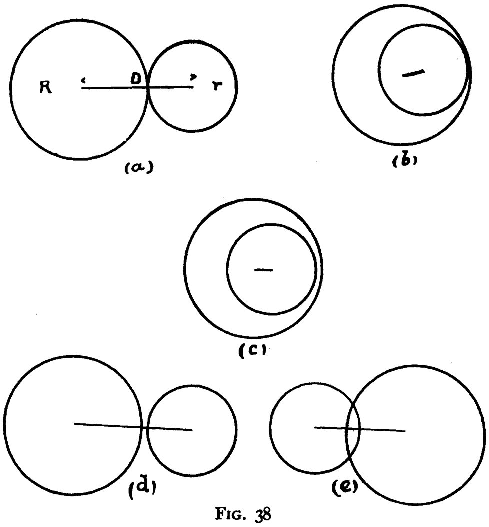

FIG. 38

47. Denote the distance between the centres of two circles by D, the radius of the larger circle by R, and of the smaller by r. Write as an equation the relation between these quantities (a) for external tangency; (b) for internal tangency; (c) for one circle wholly within the other; (d) for one wholly without the other, and (e) for the intersection (cutting) of the circles.

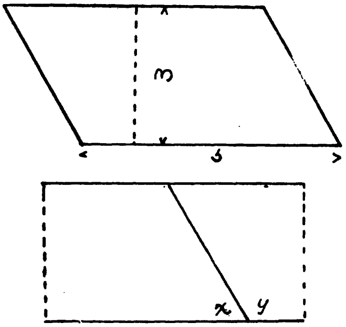

FIG. 39

48. Draw a parallelogram, and cutting it square across, turn the pieces about and fit them together as in the figure. Taking length and depth as indicated, what is the area?

49. Denoting one of the small angles of the parallelogram by x and a large one by y, by

fitting the ends over each other can you tell the sum of all the angles of the parallelogram?

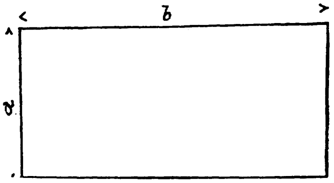

FIG. 40

50. If a carpet is 2½ feet wide, how many yards will be needed to cover the floor of a room *a* yards long by *b* yards wide? How many if the carpet is *c* feet wide?

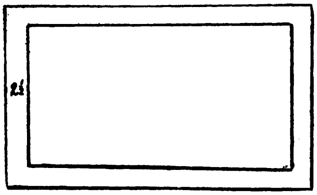

FIG. 41

51. A room is *a* feet long and *b* feet wide. How many square yards are there in a rug that covers the middle of the floor, leaving a 2½-foot strip uncovered all round the room? How many square yards if the strip is *c* yards wide?

52. What part of the oblong of Fig. 16 is: (a) A horizontal row of small squares? (b) A vertical row? (c) What part of the oblong is one small square? (d) How many small squares in a horizontal row? (e) In what other way, then, may you answer a? And b? (f) What part of the oblong is a horizontal row plus a vertical row?

NOTE.—Indicate your steps thus:

$$\tfrac{1}{3}+\tfrac{1}{7}=\tfrac{7}{21}+\tfrac{3}{21}=\frac{7+3}{7\times 3}.$$

NOTE.—Supply a number of exercises like this, using arithmetical numbers.

53. Answer the same questions for the adjoining figure as are asked in the last exercise, indicating your steps as there directed. Make a rule which applies to the addition of any two fractions having 1 for numerators.

54. (a) What part of the oblong is two vertical rows of squares? (b) Two horizontal rows? (c) What part of the oblong is the sum of two vertical and two horizontal rows?

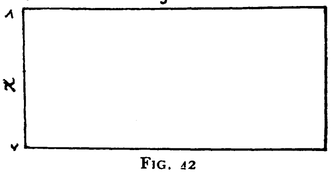

FIG. 42

NOTE.—Indicate your work thus: $\tfrac{2}{10}+\tfrac{2}{9}=2(\tfrac{1}{9}+\tfrac{1}{10})$. Give other exercises like this.

55. Answer the same questions for the adjoining figure as are asked in Exercise 54, and from your answers make a rule by which you may add quickly any two fractions having 2 for numerators.

56. Of the days of July 18% were cloudy. How many days were cloudy? How many were clear?

57. *R* per cent of the days of April were cloudy. How many days were clear?

58. Six per cent of *b* days were clear. How many days were cloudy?

59. *R* per cent of *a* days were clear. How many days were clear?

60. If *b* denote the base, *r* the rate per cent, and *p* the percentage, what law (equation) can you write connecting these numbers?

61. If *P* denote the principal, or the interest, on $1 for one year, and *I* the interest on the whole principal for the time, *t*, in years, what relation (equation) connects these numbers?

REMARK.—In every case precede the literal problem with analogous problems in arithmetical numbers.

Textiles and Fabrics: The seventh and eighth grades will weave small rugs or maps on the school loom. They will begin the making of textile designs on squared paper, and the building of the chain.

Latin: The class has been able to do more work than was planned in the December outline for the eighth grade. They will continue the reading lessons prepared for the Ninth Grade (pp. 327-329, December COURSE OF STUDY). In addition they will use the lessons printed on pages 475-481 of this number.

Music: (See Seventh Grade outline.)

Physical Training: Class practice: Series of free exercises—standing, marching, hopping, running, use of hand apparatus, elementary apparatus gymnastics, use of adjustable, horizontal, vertical, and hanging parallel bars and vaulting apparatus. Individual practice: Standing and running, broad and high jumping, rope-climbing with foot-grasp; comparison with December records at end of month. Games (indoors): basket-ball; (out-doors): hare and hounds.